Earth Sciences

Looking for an ozone hole in the Arctic

Thule, a lonesome outpost above the Arctic Circle on the northwest coast of Greenland, may not seem like an ideal place to visit in the middle of winter. Nonetheless, a team of researchers, having previously studied the loss of ozone over Antarctica, arrived last week in Thule to measure the chemical compounds floating in the stratosphere over the Arctic.

Satellite and balloon measurements over the past several years have suggested that Arctic ozone concentrations drop during the winter months (SN: 10/4/86, p.215), in a pattern reminiscent of but slightly different from the dramatic ozone fluctuations over Antarctica. However, scientists are still debating whether these observations indicate that the Arctic has an ozone "hole" of its own. To help resolve the debate, the team of scientists from the National Atmospheric and Oceanic Administration will be using remote-sensing equipment to make ground-based measurements of ozone levels. In addition, they will measure compounds of reactive nitrogen, chlorine and bromine. In the Antarctic, scientists have demonstrated that human-made chlorine chemicals play a key role in the destruction of ozone (SN: 10/10/87, p.230).

Geothermal energy sources may heat up

With the depressed market price of foreign petroleum and the seeming abundance of U.S. coal reserves, interest is waning for alternative energy sources such as solar, wind and geothermal power. But a report from the National Research Council (NRC) last week emphasized that the low price of hydrocarbon fuels will not continue for long, and that with funding and development, several forms of geothermal energy may become economically viable in the near future.

Heat from the earth has been used to generate electricity ever since a 1904 experiment in Lardello, Italy, harnessed heat from underground steam to power five lightbulbs. Today, power plants in the United States, New Zealand, Mexico and elsewhere are producing power from subsurface hydrothermal systems, which hold either steam or heated fluids. Aside from the currently viable hydrothermal systems, the NRC also described three other potential sources of geothermal energy: deep pressurized-fluid systems below 4,500 meters; hot, dry rock systems; and magma systems.

As a result of their study, the NRC recommends that the Department of Energy's Geothermal Technology Program receive increased funding in order to research and develop both near- and long-term geothermal resources. Funding for this program has decreased from a high of about $158 million in 1979 to $21 million in 1987. The NRC also suggests forming a Geothermal Research Organization that could coordinate U.S. research projects.

Snow and the El Niño

Traditional theories about the causes of the El Niño-Southern Oscillation (ENSO) — a sometimes devastating turnabout in Pacific weather patterns — have focused on a complex and not completely understood exchange of energy between the Pacific-Indian ocean system and the atmosphere above. But new studies on computer models suggest that snowfall on the Eurasian land mass and other continental processes may play important roles in the development of an ENSO. In the Jan. 29 SCIENCE, Tim P. Barnett from the Scripps Institution of Oceanography in La Jolla, Calif., and his colleagues at the University of Hamburg in West Germany report that during years with above-average snowfall, extra spring meltwater retards the heating of the Eurasian continent and weakens the summer monsoon. Such a process may be important because empirical evidence indicates a close relationship between ENSOs and weak monsoons.

Space Sciences

Space shuttle: Homecoming options

Though getting the space shuttle up and into orbit for the first time in 2½ years is the main focus of attention—the launch is now scheduled for Aug. 4 — NASA is also working to ensure that there is a choice of safe places for the craft to land.

The primary site is still Runway 17 at Edwards Air Force Base in California, where 18 of the 24 successful shuttle flights ended. Rain can be a factor even in the Mojave Desert, however, and five shuttles have descended directly from orbit to Kennedy Space Center (KSC) in Florida. Since this is where the shuttles are launched, landing at KSC eliminates the need to bolt the craft atop a Boeing 747 jet and fly it back east so it can take off again. But direct KSC landings stopped with Mission 16 on April 19, 1985, when the shuttlecraft Discovery blew a tire and suffered brake damage as it touched down on the rough-surfaced runway. KSC's 15,000-foot runway is also less than half as long as the one at Edwards, and much narrower, making the West Coast facility the strong preference of the astronauts who must bring the shuttle safely back from space. In addition, KSC is often beset by rains on short notice, so that its landing strip is sometimes unavailable.

As a result, the Florida facility is not even NASA's second choice. The agency has now designated "White Sands Space Harbor" (formerly known as Northrup Strip) in New Mexico as the backup site for at least the next three shuttle missions, with KSC to be used only if needed for emergencies. The one shuttle mission that ever landed at White Sands, No. 3 in March of 1982, was sent there because of rain that had left the Mojave strip—a dry lake bed — muddy.

Even so, work was begun on Jan. 29 to modify the shuttle landing strip at KSC, smoothing 3,500 feet of the surface at each end and replacing a series of grooves that run across the strip with narrower ones that are aligned lengthwise like a "corduroy road". The primary purpose of the alterations, according to KSC officials, is to reduce tire wear, though another goal is to hasten the disappearance of water from the frequent rains. In addition, landing-light fixtures are being modified, and markings are being repainted on the entire runway. Although the KSC strip will initially serve only as a "backup backup" shuttle landing site, NASA says the landing site options "will be reassessed after the next three missions."

IUE: Ten years and still working

When the International Ultraviolet Explorer satellite (IUE) was launched on Jan. 26, 1978, it was planned to operate for three years, with an optimistic hope that it might hold on for five. It has just completed a decade on the job.

IUE is the only astronomy satellite to have been placed in a geosynchronous orbit, where it is positioned more than 22,000 miles above a fixed point on earth, notes Theodore Snow, director of the University of Colorado's Center for Astrophysics and Space Astronomy. This has enabled the satellite to be in use 24 hours a day. The telescope that is essentially its entire payload has been described by some astronomers as the most productive ever built, and Yoji Kondo of the NASA Goddard Space Flight Center in Greenbelt, Md., notes that its data have contributed to more than 1,400 refereed scientific papers. According to Kondo, nearly 1,600 different observers have used IUE, virtually all of them "guest observers" rather than members of an official "project team."

IUE was launched with six gyroscopes (half of them spares) in its aiming and stabilization system, but four of them subsequently failed, leaving the craft dependent on two gyros and its "sun sensor." Since then, however, engineers have determined that it could operate with only a single gyro, or possibly none. According to Kondo, it is possible that the hardy craft could keep working until as late as 1995 or 1996.